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Method of common resource status management for a complex computer system.

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Proprietor : **HITACHI, LTD.
6, Kanda Surugadai 4-chome
Chiyoda-ku, Tokyo 100 (JP)**

Inventor : **Shinmura, Yoshiaki
244o, Nakadacho
Totsuka-ku
Yokohama (JP)**

Representative : **Patentanwälte Beetz - Timpe -
Siegfried Schmitt-Fumian - Mayr
Steinsdorfstrasse 10
D-80538 München (DE)**

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Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates to a common resource management method for a complex computer system in which resources are used commonly among a plurality of computers.

DESCRIPTION OF THE PRIOR ART

In a complex computer system including a plurality of computers, common resources are used commonly among these computers. The status of a common resource (e.g., setting of recording mediums, occupancy of data sets, etc.) has been managed by each computer individually. Each computer has tables for storing status information of the resources in its main storage or virtual memory so that access control to each resource is implemented using the status information.

This conventional resource management method has the following problems. When a computer has set the status of a resource, it must be informed to other computers which share the resource. However, each computer has independent tables containing resource status information, and therefore the process is required for notifying other computers of the status information set by one computer. This notification is implemented by the unit called channel-to-channel adapter (CTCA). Information notified includes as to whether the resource is being used in the shared mode or exclusive mode, the volume serial number of the recording medium, the attribute of the volume and the like. Because of different motivation of notification for each type of information, there is a need to provide a plurality of control means for respective types of information. A further problem is that frequent communication for the resource status information by the CTCA will adversely affect other data transfers which use the CTCA.

Another technique which is intended to improve the rate of operation of computer systems by dividing volume used for plural electronic computers in common into files, storing the using status of these files and accessing the other computer to an unused file of the volume is disclosed in JP-A-58-27255. In order to control the partial locking of a magnetic disc device, a control memory is incorporated in a magnetic disc controlling device in this prior art. The control memory can store locking states and stores "in using", "using counter", "CPU to be used" and "unused" in each locking state to control data. If a system accesses to a file while that file is being used control memory is searched and the access is waited until the end of file. When the accessed file is not used, the

using status of the file is stored in the control memory and the file is accessed. Consequently plural files of one volume can be used simultaneously.

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SUMMARY OF THE INVENTION

The invention is set out in the claim.

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Accordingly, it is an object of this invention to provide a method of common resource management for a complex computer system, which eliminates the transfer of common resource status information among computers.

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Another object of this invention is to unify the management of common resource status information among computers.

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According to one aspect of this invention, a common resource is provided therein with an individual memory for storing status information, and computers sharing the resource are allowed to access to the memory for referencing or revising the status information.

BRIEF DESCRIPTION OF THE DRAWINGS

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Fig. 1 is a diagram showing in brief the complex computer system to which the present invention is applied;

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Fig. 2 is a diagram showing the recording format of the associated memory shown in Fig. 1; and Fig. 3 is a flowchart of the resource status management process according to the present invention.

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DESCRIPTION OF THE PREFERRED EMBODIMENT

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In Fig. 1 showing the inventive computer system, computers 1 and 2 have individual processing functions. An optical disk library unit (OLU) 4 possesses several optical disk cartridges 11, two of which are mounted on optical disk drivers (ODD) 6 and 7 by means of an automatic disk changer (ADC). The mounted optical disk cartridges 11 are rendered reading and writing under control of an optical disk string controller (OSC) 5. An optical disk controller (ODC) 3 controls the optical disk library unit 4 in accordance with the instructions issued by the computers 1 and 2. The optical disk library unit 4 differs from conventional ones in the provision of an associated memory 9 and its read/write controller. The conventional optical disk controller and optical disk unit operate as described in U.S. Patent No. 4,525,839, which is hereby incorporated by reference.

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The computers 1 and 2 are arranged to issue novel instructions, VSN READ command and VSN WRITE command, for making access to the associated memory 9. In addition to the conventional microprogram for interpreting commands issued by the

computer to implement specified processings, the optical disk string controller 5 has a microprogram for carrying out the following processings in response to the VSN READ and VSN WRITE commands. Further hardware arrangement is provided in a conventional internal memory for transferring data with computers means for communicating data with the associated memory 9.

In response to receiving the VSN READ command, the microprogram retrieves data from the memory 9 addressed by the command and sends it to the computer. Alternatively, in response to receiving the VSN WRITE command, the microprogram writes data received together with the command into the memory 9 addressed by the command. Namely, the optical disk library unit 4 merely implements reading and writing in the associated memory 9 addressed by the computers and does not further deal with data and address.

Fig. 2 shows the recording format of the associated memory 9, which is established commonly for all computers when the system is built. The format consists of OLU information 21 including an identifier of the OLU, information indicating the type of OLU and information indicating the validity of the associated memory 9, ODD information 22 including an ODD identifier, the cartridge number of the disk mounted on that ODD (any of 1-32 in this embodiment) and information indicating the front/rear side of the disk to which read/write access is allowed, cartridge information 23 indicating the presence of a cartridge in each cartridge cell (32 cartridge cells in this embodiment), optical disk cartridge information 24 indicating the volume serial number (VSN) for the front side (VSNA) and the volume serial number for the rear side (VSNB) of the cartridges accommodated in the cartridge cells, and a spare area 27. When there is no cartridge in the cell 16, the optical disk cartridge information 24 has no VSNA and no VSNB for this cell 16. Each cartridge consists of one sheet of optical disk, and each side of an optical disk constitutes a volume.

Next, the inventive optical disk library management process will be described. Fig. 3 shows in flowchart the optical disk library management process carried out by the computers in advance of the conventional read/write access to an optical disk. The conventional read/write operation which follows the resource status management process will not be explained here.

Initially, a computer issues a device reserve command as in the conventional disk read/write operation. The optical disk controller 3 holds therein flag information indicative of the occupancy of the disk, tests the flag upon receiving the command, and, if the flag is found set (on), imparts the disk occupancy to the computer (step 40). Receiving this message of occupancy, the originating computer implements the error report process (step 41) and terminates the re-

source status management process. When the flag is found reset (off), the optical disk controller 3 sets the flag (on) and imparts the availability of the disk to the originating computer (step 40).

The computer next issues the VSN READ command to fetch the contents of the associated memory 9 (step 31). At this time, the operation required for the optical disk library unit 4 is to read out the contents of the associated memory 9 and transfer it to the computer. The management routine analyzes the OLU information 21 in the contents of the associated memory 9 to determine whether it is the intended OLU and whether the associated memory is valid (step 32). If the associated memory 9 is found invalid, the routine initializes the associated memory 9. The routine first reads information to know whether a cartridge is present in each cell (step 33). Subsequently, the routine mounts the cartridge of each cell onto the optical disk driver 6 sequentially to read the volume serial number (step 34). The routine edits write information for the associated memory 9 basing on the above information, sets the validity information for the associated memory 9 (on), and subsequently issues the VSN WRITE command to rewrite the contents of the associated memory 9 (step 35). Then the sequence proceeds to step 36. In case the associated memory 9 is found valid in step 32, the sequence immediately proceeds to step 36. The step 36 analyzes the ODD information 22 and optical disk cartridge information 24 to determine whether the intended volume is set on the driver. For a system having more than one optical disk driver, checking is made to identify the driver on which the volume is mounted (step 36). Knowing that the intended volume is mounted on the driver, the computer issues a device release command to reset the occupancy flag in the optical disk controller 3 (step 39) and terminates the resource status management process. If the disk on the driver is found to be other than the intended one, the routine analyzes the optical disk cartridge information 24 to know the cartridge number of the intended volume, and mounts it on the driver (step 37). Subsequently, the routine revises the ODD information 22 and cartridge availability information 23 in the associated memory 9 (step 38), and then the sequence proceeds to the above-mentioned step 39. Thereafter, the access operation to the mounted optical disk will take place in the same manner as in the conventional system.

When other computer intends to make access to the optical disk library unit 4, the processing exactly the same as described above will take place. Namely, the computer reads out the associated memory 9 to check its status. The associated memory 9 has already been initialized, causing the associated memory validity information to be active, and therefore the status of the optical disk library unit is made known immediately by the read-out information.

As described above, the present invention allows

the computers in the system to know the latest status of the shared resources without transferring status information among the computers.

Claims

1. A method of common resource status management for a computer system including a plurality of computers (1,2) coupled to a common resource (4) which is shared among said plurality of computers, said common resource (4) having a memory (1) for recording information indicating the status of said common resource, said method being characterized by the following steps:
 A first step of storing status information indicating data set occupancy, availability and content identification of said common resource (4) in said memory (9) of said common resource (4) for access of any of said computers (1,2); and
 a second step of reading (VSN READ) said status information in said memory (9) in advance of access to said common resource (4) by one of said plurality of computers (1, 2) and sending said read status information to said one computer;
 a third step of determining by said one computer, data set occupancy or availability, and in case of availability, further determining whether said data set content identification status information read in said second step is valid, wherein valid data set content identification status information shows that the content identification status information corresponds in fact to the current data set contents of said common resource whereas invalid data set content identification status information shows that the status information does not correspond to the current data set contents of said common resource,
 a fourth step of accessing said common resource by said one computer to identify the current data set content of said common resource and revising said read data set content identification status information to correspond to said current contents if said read content identification status information has been found invalid in said third step; and
 a fifth step (VSN WRITE) of storing said revised data set content identification status information in said memory (9) of said common resource (4).

Patentansprüche

1. Verfahren zur Verwaltung einer gemeinsamen Einrichtung für ein Computersystem mit einer Vielzahl von Computern (1, 2), gekoppelt an eine gemeinsame Einrichtung (4), welche sich eine Vielzahl von Computern teilen, wobei die gemeinsame Einrichtung (4) einen Speicher (1) für

die Aufnahme von Information, die den Status der besagten gemeinsamen Einrichtung anzeigt, hat, wobei das besagte Verfahren gekennzeichnet wird durch die folgenden Schritte:

- einen ersten Schritt der Speicherung der Statusinformation, die die Belegung, die Verfügbarkeit und Inhaltsidentifizierung eines Datensatzes der besagten gemeinsamen Einrichtung (4) anzeigt, in den besagten Speicher (9) der gemeinsamen Einrichtung (4) für den Zugriff durch irgendeinen der besagten Computer (1, 2); und
- einen zweiten Schritt des Lesens (VSN READ) der besagten Statusinformation in dem besagten Speicher (9) vor einem Zugriff auf die besagte gemeinsame Einrichtung (4) durch einen aus der Vielzahl der Computer (1, 2) und Absenden der besagten Lesestatusinformation an den besagten einen Computer;
- einen dritten Schritt der Entscheidung durch einen Computer über die Belegung oder Verfügbarkeit eines Datensatzes und im Falle der Verfügbarkeit weiterhin der Entscheidung, ob die besagte Datensatzinhaltsidentifizierung, die als Statusinformation in dem besagten zweiten Schritt eingelesen wurde, gültig ist, wobei gültige Datensatzinhaltsidentifizierung als Statusinformation anzeigt, daß die Inhaltsidentifizierung als Statusinformation tatsächlich dem aktuellen Datensatzinhalt der besagten gemeinsamen Einrichtung entspricht, während ungültige Datensatzinhaltsidentifizierung als Statusinformation zeigt, daß die Statusinformation dem aktuellen Datensatzinhalt der besagten gemeinsamen Einrichtung nicht entspricht,
- einen vierten Schritt des Zugriffs auf die besagte gemeinsame Einrichtung durch den besagten einen Computer, um den aktuellen Datensatzinhalt der besagten gemeinsamen Einrichtung zu identifizieren und die besagte eingelesene Datensatzinhaltsidentifizierung als Statusinformation so zu revidieren, daß sie dem aktuellen Inhalt entspricht, wenn die besagte eingelesene Inhaltsidentifizierung als Statusinformation als ungültig in dem besagten dritten Schritt befunden wurde; und
- einen fünften Schritt (VSN WRITE) des Abspeicherns der besagten revidierten Datensatzinhaltsidentifizierung als Statusinformation in dem besagten Speicher (9) der besagten gemeinsamen Einrichtung (4).

Revendications

1. Procédé de gestion de l'état d'une ressource commune pour un système informatique comprenant une pluralité d'ordinateurs (1,2) couplés à une ressource commune (4) qui est utilisée en commun par ladite pluralité d'ordinateurs, ladite ressource commune (4) possédant une mémoire (1) pour l'enregistrement d'une information indiquant l'état de ladite ressource commune, ledit procédé étant caractérisé par les étapes suivantes :
 - une première étape consistant à mémoriser une information d'état indiquant l'état d'occupation, la disponibilité et l'identification du contenu d'un ensemble de données de ladite ressource commune (4) dans ladite mémoire (9) de ladite ressource commune (4) pour l'accès à l'un quelconque desdits ordinateurs (1,2); et
 - une seconde étape consistant à lire (VSN READ) ladite information d'état dans ladite mémoire (9) avant l'accès à ladite ressource commune (4) par un premier ordinateur de ladite pluralité d'ordinateurs (1,2), et envoyer ladite information d'état audit premier ordinateur;
 - une troisième étape consistant à déterminer, par ledit premier ordinateur, l'état d'occupation ou de disponibilité de l'ensemble de données et, en cas de disponibilité, à déterminer en outre si ladite information d'état d'identification de contenu de l'ensemble de données, lue lors de ladite seconde étape est valable, une information valable d'état d'identification de contenu de l'ensemble de données indiquant que l'information d'état d'identification de contenu correspond en réalité au contenu actuel de l'ensemble de données de ladite ressource commune, tandis qu'une information non valable d'état d'identification de contenu de l'ensemble de données indique que l'information d'état ne correspond pas au contenu actuel de l'ensemble de données de ladite ressource commune,
 - une quatrième étape consistant à accéder à ladite ressource commune par ledit premier ordinateur pour identifier le contenu actuel de l'ensemble de données de ladite ressource commune, et à réviser ladite information d'état d'identification de contenu de l'ensemble de données pour qu'elle corresponde audit contenu actuel si ladite information d'identification de contenu lue s'est avérée être non valable lors de ladite troisième étape; et
 - une cinquième étape (VSN WRITE) consistant à mémoriser ladite information révisée d'état d'identification de contenu de l'ensemble de données dans ladite mémoire (9) de ladite ressource commune (4).

FIG. 1

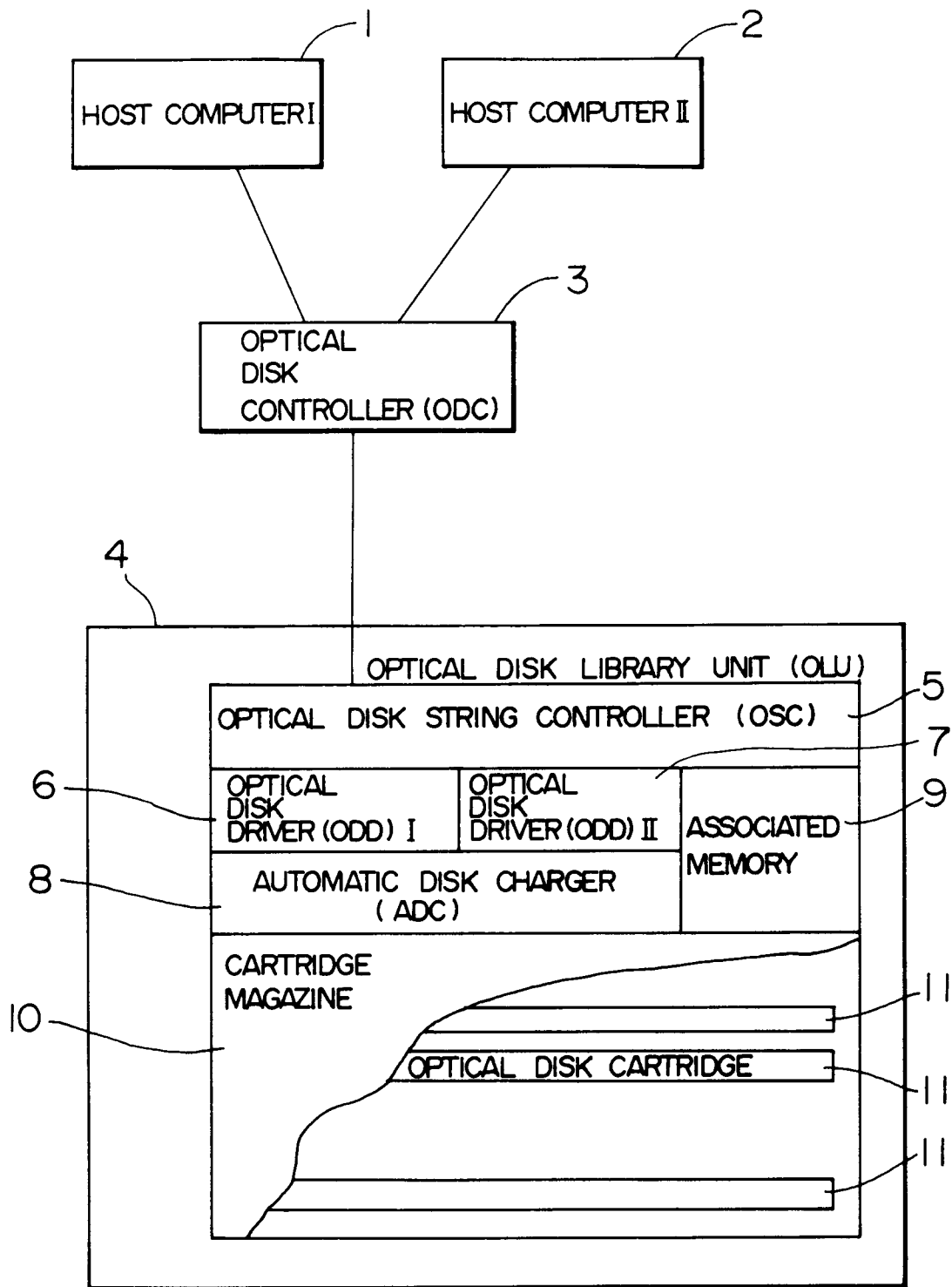


FIG. 2

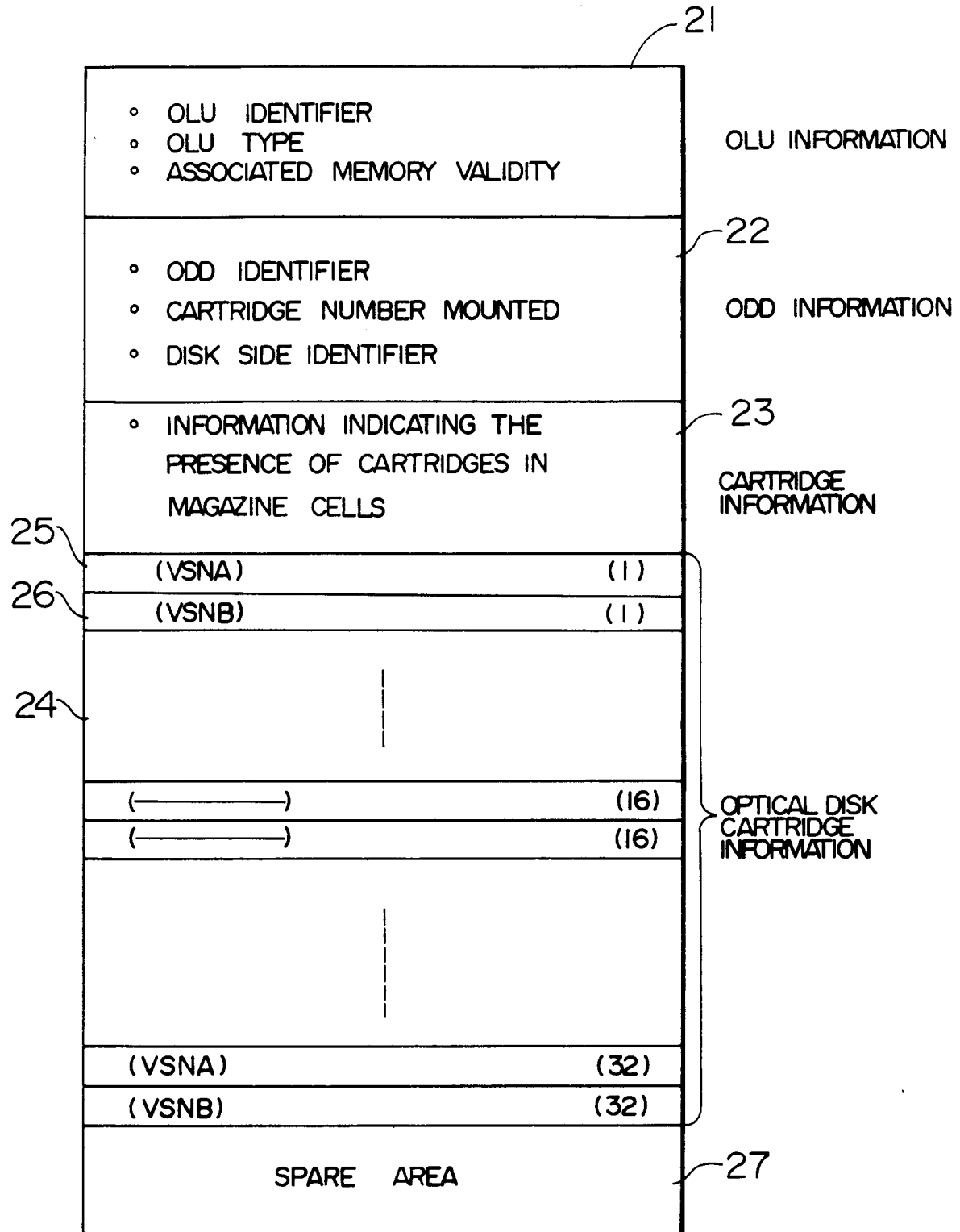


FIG. 3

